



LEE SAN

Bilge Water Treatment
Sewage Treatment
Ballast Water Treatment Systems

www.leesangroup.com



LEE SAN INTERNATIONAL GROUP LIMITED

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LEE SAN INTERNATIONAL GROUP LIMITED AGENT LIST

No.	Equipment Name	设备名称	Manufacturer (生产厂家)	Country Of Origin (原产国)
1	Exhaust Gas Cleaning/ SCRUBBER	脱硫塔	WÄRTSILÄ	Finland/China
2	Stern tube & STERN TUBE BEARING & SEALING & INTERMEDIATE SHAFT BEARING	艏管&艏管轴承&密封 &中间轴轴承	WÄRTSILÄ (JMT)	Japan/China
3	Oily Water Separator	油水分离器	RWO GmbH	Germany/ Sole agent in China
	Sewage Treatment Plant	污水处理		
	Clean Ballast Water Treatment	压载水处理		
4	High Pressure Washing Unit	高压清洗设备	SIOUX CORPORATION	U.S.A. / Sole agent in China
	Steam Cleaners Pressure Washers	蒸汽式高压清洗设备		
5	Piping Marking	管路色标	SEAWARD SAFETY LIMITED	UK / Sole agent in China
	Photo Luminescent Low Level Escape Route Systems	低位逃生系统		
	Safety Awareness System Additions Section And Signs	安全标记标识		
	Anti-Slip	防滑设备		
6	ICCP System	阴极保护设备	AZIENDA CHIMICA GENOVESE	ITALY/ Sole agent in the north of China
	MGPS System	防海生物设备		

Total Water Management On-board Ships and Offshore Platforms

Who We Are

For more than 45 years the RWO experts develop, design, manufacture and service high-quality technologies for water treatment onboard ships and offshore installations, both for new installations or retrofitting. The product portfolio includes the treatment of drinking and process water as well as pollution prevention equipment for oily waters, ballast and wastewater as well as a comprehensive range of after sales services. RWO is the worldwide market leader in the treatment of marine oily water. The main offices are located in Bremen, Germany.

Worldwide Sales & Service Network

RWO's international network of more than 40 qualified sales/service stations ensures short communication links between customer and manufacturer, making us the ideal partner for companies in the maritime sector. Contact us today to find out more about the way we work.



Key Competences

The RWO brand stands for decades of experience in the construction and service, in all field of maritime water treatment, inclusive of:

- > Oil Water Separation
- > Wastewater Treatment
- > Drinking Water Treatment
- > Process Water Treatment

Key Benefits

- > High quality in every aspect
- > Worldwide network and support
- > Comprehensive experience in water treatment engineering
- > Get your water management solution from the market leader in OWS

RWO

RWO's Classic: OWS-COM Oily Water Separator

Complying With Your Challenges Fulfilling the 5 ppm Standard

More than 16000 ships have already been equipped with RWO's oily water separators since RWO started its business in 1975. The OWS-COM system uses a combination of **highly effective open porous coalescer with automatic backflushing, together with a second stage emulsion breaking oil and hydrocarbon polisher.**

The periodical backflushing keeps the coalescer surface clean and offers long lasting operation according to IMO MEPC.107(49). The OWS-COM is part of RWO's leading **Total Water Management** offer.

Reliably reaches
**5 ppm
limit**
confirmed by
DNV GL and LR

- > IMO type approved
- > MED certified by German Administration
- > Approved by USCG, ABS, DNV-GL, RMRS, RRR, CCS



Oil Content Monitor

The RWO oily water separating system is equipped with a 15 ppm oil content alarm device, type tested and approved in accordance with IMO Resolution MEPC.107(49). During flushing of the sensor the overboard discharge valve is in recirculation mode.

According to IMO MEPC.107(49) an additional hand-operated 3-way valve is installed downstream of the oily water separator in the overboard line to recirculate the water to the bilge whenever required during Port State Control.



Automatic Bypass

To extend the operating life of the demulsifier, an automatic bypass is fitted to the separating system. The oil content monitor periodically checks the water quality of the first stage separator. If below the set max. value, the demulsifier is bypassed. This results in lower operational cost and long product life.

Key Features & Benefits

- > Most economical: second stage is bypassed whenever possible
- > Easy to install and maintain
- > Oil monitoring device continuously checks effluent
- > Suction type: preserves pump from attrition
- > Most compact: suitable for newbuildings and retrofits
- > Improved hydrodynamics for longer polisher lifetime

Type	Capacity m ³ /h	Length mm	Width mm	Height mm	Power kW	Empty weight kg
0.1	0.1	715	650	1100	0.8	125
0.25	0.25	960	750	1005	2.6	180
0.5	0.5	970	750	1050	3.2	195
1.0	1.0	1170	800	1220	3.2	270
2.5	2.5	1510	1060	1485	3.7	457
5.0	5.0	1825	1385	1715	4.6	757
10.0	10.0	2155	1575	2000	5.7	1195

RWO

CBM+ Bilge Water Compliance Monitoring System

Enabling Safe Discharge of Uncontaminated Water Overboard

The clean bilge monitoring system CBM+ is the monitoring system for tankers, cruise vessels and other ships with additional focus on environmental compliance. It is designed to monitor and control liquid discharges overboard your vessel in respect of its oil content. The system prevents the discharge of non-compliant oily water mixtures by automatically recirculating the liquid to the bilge water tank if the oil content is above a predetermined limit.

This compact system can be installed as a last monitoring and control device in the outlet pipe prior to the overboard discharge valve for safety purposes. Although designed with bilge water in mind other discharges like clean drains e.g. condensate from air conditioners can be monitored as well. The system independently monitors whether the maximum oil content is reached depending on the selected set-point of 5 or 15 ppm. Lower set-points can also be chosen on site.



CBM+ is a reliable system prior to discharging bilge water

The unit enables the safe discharge of uncontaminated water overboard. However, if there is oil present and it reaches a specific limit, a 3-way valve automatically returns the liquid to the bilge tank for further treatment. This way compliance with IMO MEPC.107(49), particular sensitive sea areas (PSSA) or other class or vetting regulations can be ensured.

Proof of Location by GPS Data

CBM+ includes an input of GPS data from the ship and multiple electrical potential free contacts that enable the connectivity to the ships' AMS system.

The system records and stores data on date, time, location, flow rate and oil content of every operation for 18 months. All relevant data is available via the system's touch screen and can be downloaded. This enables the crew to present the discharge data to port state control or other involved authorities.

Tamper Proof

The unit is designed as a standalone device, ready for plug and play and does not require any connection to an existing oily water separator. The housing of this tamper-proof designed unit is locked and any opening of the doors is recorded.

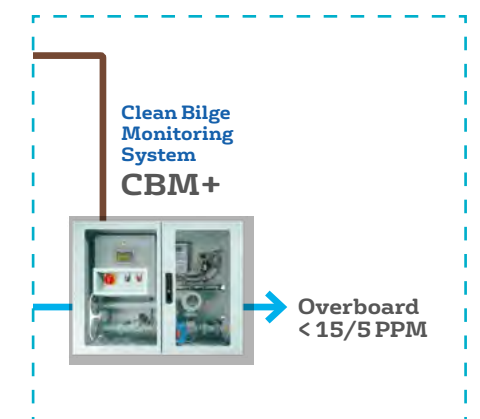
While the ship is in port or restricted areas, a so called 'Port Switch' can be enabled. In this mode the 3-way valve is locked in recirculation mode to prevent any overboard discharge.

Compliance

CBM+ is the perfect tool to prove that your vessel and crew comply with the respective laws and regulations.

Key Features & Benefits

- > Final compliance monitoring system directly prior to overboard discharge
- > Easy to read display of ppm curves
- > Tamper proof record of all relevant data
- > Connectivity to ships AMS
- > Compact plug & play design
- > Tamper proof housing
- > High quality components made in Germany



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RWO

CleanSewage-BIO Biological Sewage Treatment

Sewage Treatment With Minimal Efforts

CleanSewage-BIO is a compact, type approved marine Sewage Treatment Plant (STP) for cargo vessels. With an incorporated Moving Bed Bio-reactor (MBBR), the CS-BIO requires minimal process volume, still meeting the IMO MEPC.227(64) discharge criteria.

CS-BIO is designed for easy maintenance and operation. With the intuitive status control, operators can check at a glance, whether the system is running smoothly or intervention is necessary. The hygienic no-touch-cleaning system for sludge discharge makes maintenance nearly effortless.

The accessibility from one side allows ship designers to plan space in the engine room on a whole new level.



CS-BIO compact biological sewage treatment

How it Works

CleanSewage-BIO combines mechanical pre-treatment (screening), biological treatment by activated sludge (AS) with moving bed biofilm technology (MBBR) and solid separation via clarifier in the same tank. Compared to an activated sludge system, CS-BIO is a high efficiency solution for the removal of organic matter with very low sludge production due to the biofilm technology.

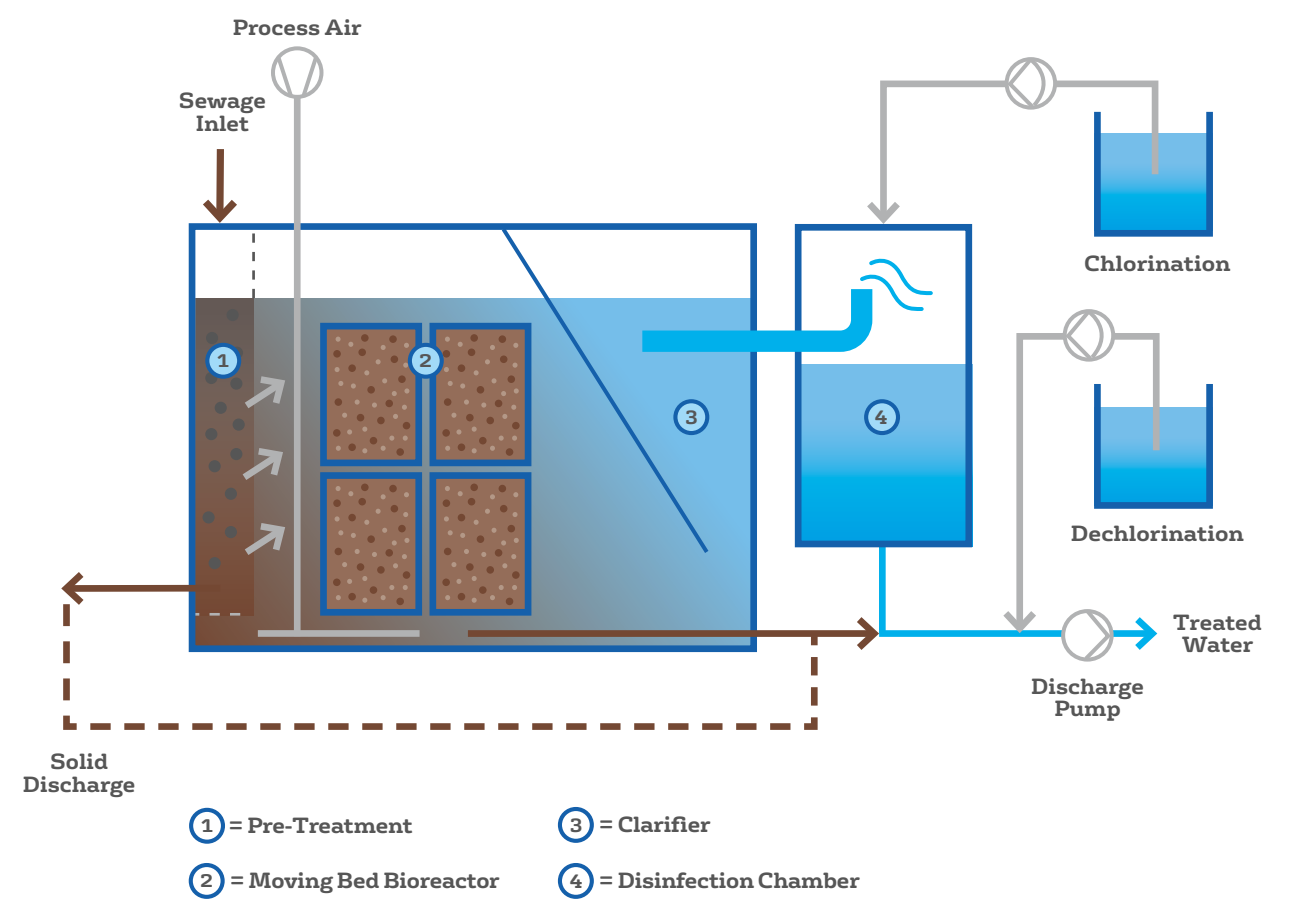
1.

As a first step the sewage is separated from heavier solids and particles by a screen, thus preventing clogging or damages in further process steps.
2.

In the biological stage, bacteria degrade organic matter into carbon dioxide and water. These bacteria grow as a biofilm on the carriers in the so-called moving bed. Aeration is applied both for the suspension of the biofilm carriers and the oxygen supply of the bacteria. As a natural process, bacteria accumulate in the system and form sludge flocs (also called excess sludge) which can be collected and disposed according to national and international laws.
3.

In the clarifier residual solids and suspended activated sludge are separated by sedimentation and turned back into the biological chamber. The clean sewage flows into the disinfection chamber.
4.

In the disinfection chamber a chlorine-based chemical is added to reduce bacteria to a minimum level. The clean water is then pumped overboard. To meet the limit values set for the chlorine content, a neutralising agent is dosed prior to the discharge pump.



Key Features & Benefits

- Safe

> Integrated mechanical pre-treatment

> No harmful or flammable chemicals

> Certificate of Type Approval for Sewage Treatment Plants according IMO MEPC.227(64) issued under the authority of the Federal Republic of Germany by BG Verkehr
- Easy to operate

> No-touch-system for hygienic sludge discharge

> 100 % control through individual switches for every component

> Fast restart after maintenance due to biomass carrier in cages

> Suitable for black & grey water
- Small

> No holding tank necessary

> Up to 25 % less space demand through unique one-side access
- Compatible with all vacuum systems

CS-BIO	Organic Load	Hydraulic Load	Dimensions L x W x H	Weight	
				Net kg	Wet kg
Size	kg/d BOD ₅	m ³ /d	mm		
02	1.38	2.16	2095 x 1250 x 1480	859	2923
03	2.07	3.24	2608 x 1346 x 1612	1149	4134
04	2.76	4.32	2559 x 1646 x 1618	1335	5293
05	4.15	6.48	2781 x 1656 x 2058	1627	7407
06	5.53	8.64	3365 x 1656 x 2058	1885	9278
07	6.91	10.80	3365 x 1986 x 2058	2121	11719

RWO

CleanSewage-MBR Membrane Bioreactor

Advanced Wastewater Treatment for Passenger Ships

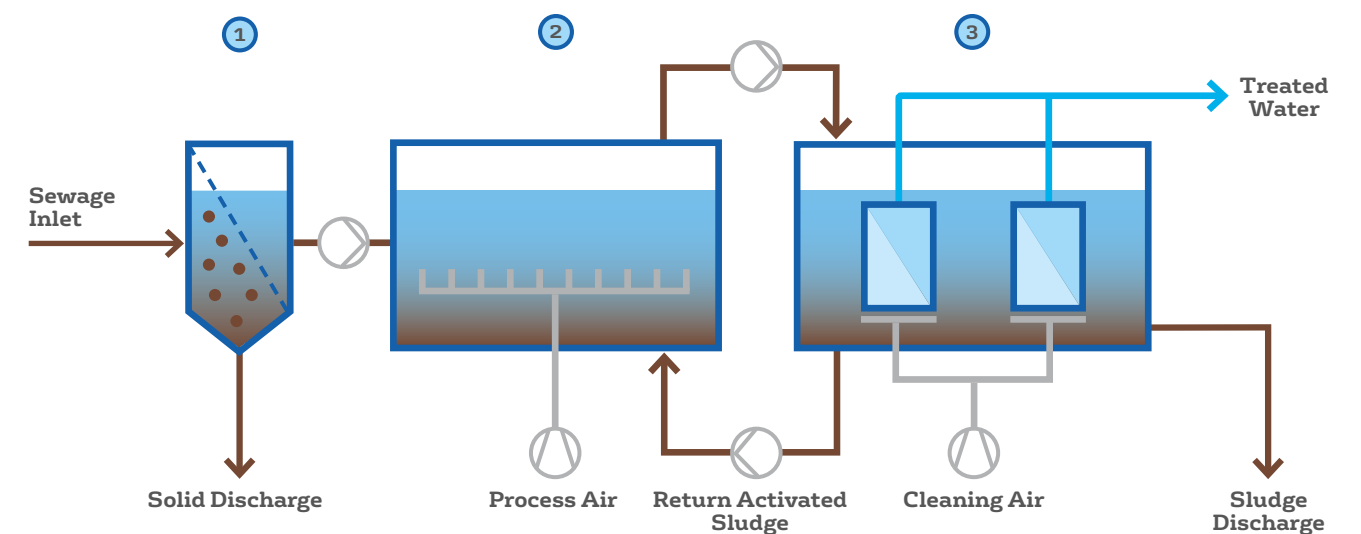
With the CleanSewage Membrane Bioreactor (CS-MBR) RWO has developed an advanced waste-water treatment (AWT) system fit for the requirements of sustainable passenger shipping as well as other high-standard applications. The CS-MBR is type approved according to the regulation IMO MEPC.227(64) including chapter 4.2 for nitrogen and phosphorus removal within special areas.



CleanSewage Membrane Bioreactor: Advanced Water Treatment from RWO

Sustainable Biological Treatment

CS-MBR is the successor of the MEMROD-Series, RWO's renown advanced water purification plant, with higher effluent quality and several operational advantages. The treatment process is divided into three steps: Solids are removed in the mechanical pre-treatment, pollutants are degraded in the biological stage and in a last step, a membrane barrier ensures absolutely reliable separation of solids, including microplastics. The submerged membrane system with extremely high mechanical strength and automated cleaning mechanism control make CS-MBR easy to operate and ensure long lifetime. The biological treatment process offers low OPEX due to low energy demand, low use of chemicals and thus a low production of solid byproducts/wastes.



① = Mechanical Pre-Treatment

② = Bioreactor

③ = Membrane Reactor

How it Works

The CS-MBR is based on a sustainable biological treatment technology that can be divided into three major process stages:

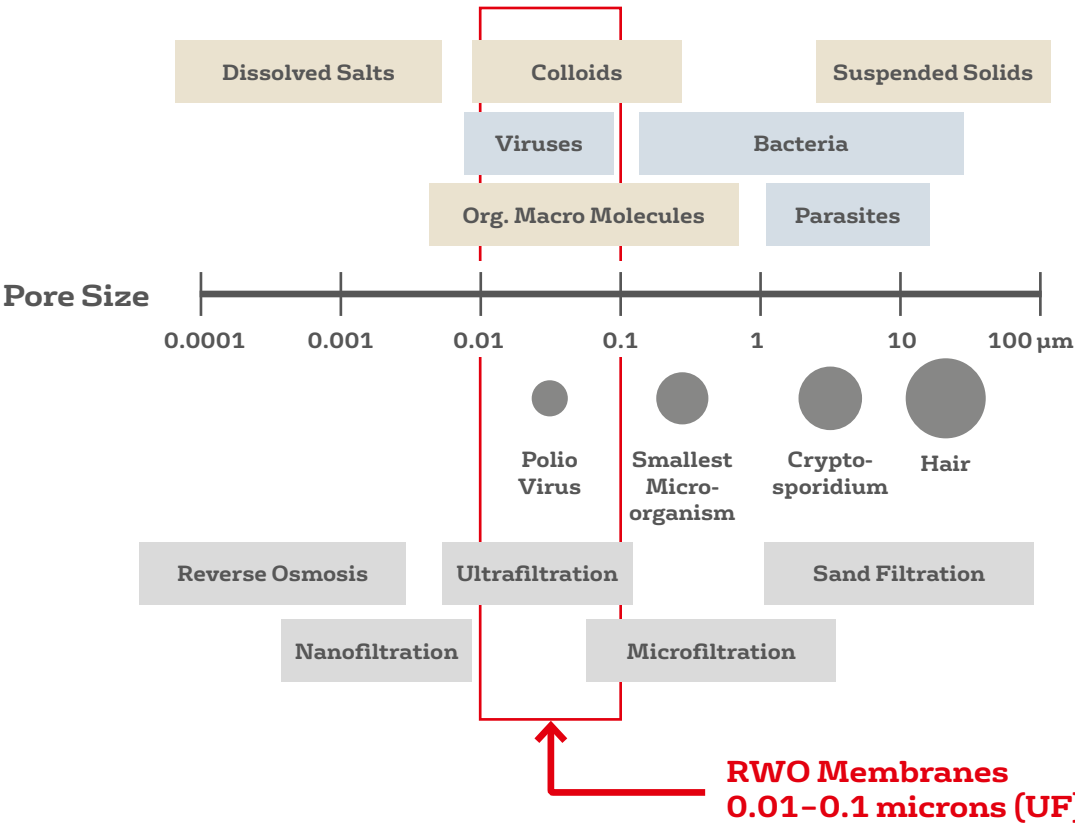
- > Mechanical pre-treatment
- > High Performance Activated Sludge Biological Treatment
- > Submersed Ultrafiltration (UF)

These modular technologies can be combined and scaled to meet individual customer requirements.

1. In the first stage, solids are removed from all incoming waste waters (blackwater, greywater from galley, accomodation, laundry, etc.). Grease separation for the galley water treatment can be added on demand.

2. The second stage consists of a high performance activated sludge process: Controlled by intelligent aeration design, bacteria remove organic pollutants, nitrogen and phosphorus from the wastewater. To achieve minimum phosphorus concentrations in the effluent, excess phosphorus is precipitated by adding coagulant.

3. In the third stage of the process, the clean water is separated from the activated sludge via a submerged membrane. While the water can pass through the membrane, sludge, bacteria, viruses and microplastics are held back as shown below. The result in downstream water is clear, free of solids and already disinfected.



Key Features & Benefits

MEPC 227 (64) compliant including special areas

- > Certificate of Type Approval for Sewage Treatment Plants according IMO MEPC.227(64) issued under the authoity of the Federal Republic of Germany by BG Verkehr

Low Footprint

- > Due to high performance activated sludge process and integrated solid separation

Minimum Maintenance Work

- > Automated membrane cleaning
- > extremely high mechanical strength of the membranes
- > Safe process design
- > User-friendly and intuitive operation

Sustainability and low OPEX

- > Membrane barrier removes more than 99 % of solids including microplastic
- > Removal of bacteria and viruses - no chlorination needed
- > No use of flocculants or chemicals for disinfection necessary
- > Low energy consumption and decreased use of chemicals
- > Low excess sludge production

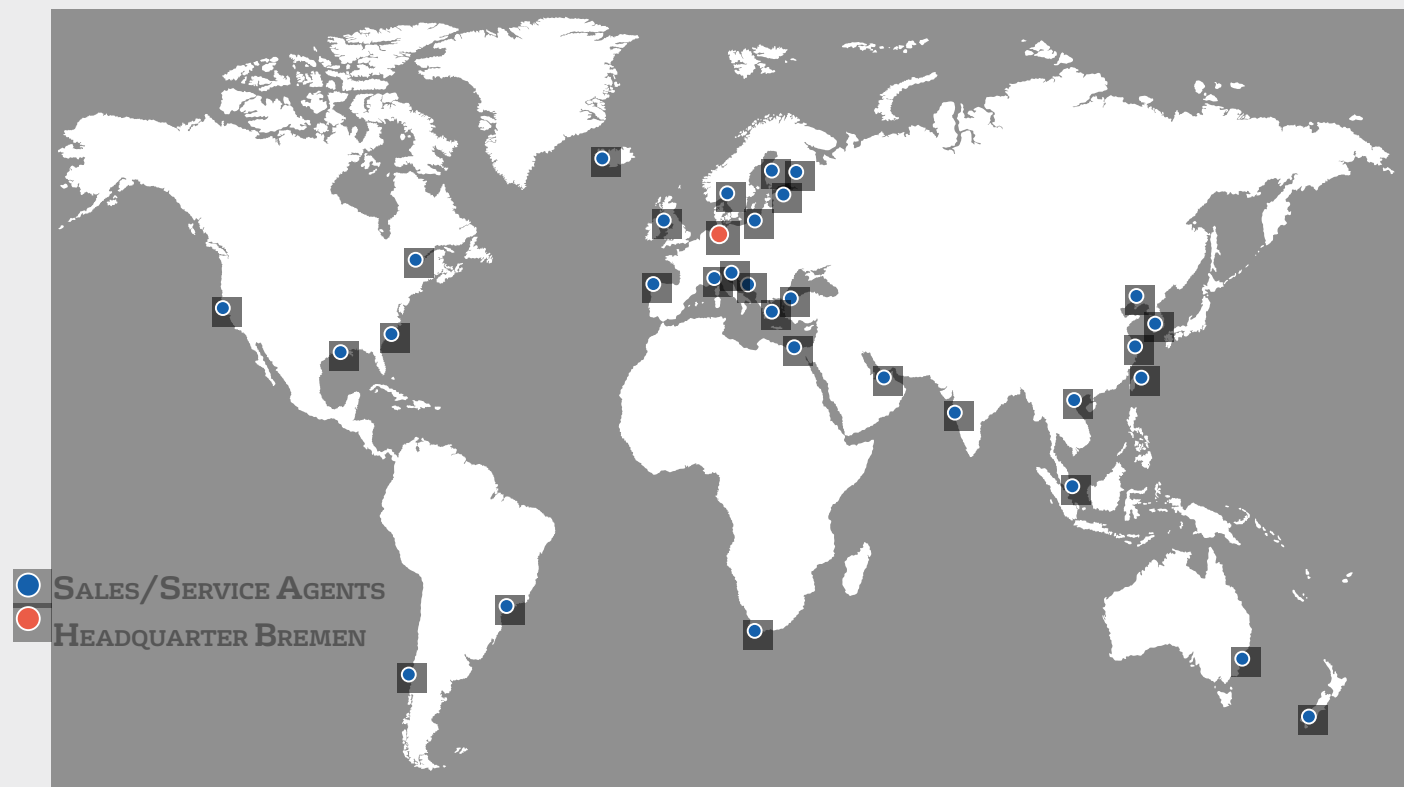
CS-MBR is designed to minimize your vessel's impact on the marine environment. The advanced water treatment plant provides highest effluent qualities as described in table (see table) and thus exceeds the requirements of the International Marine Organization (IMO MEPC.227(64) incl. 4.2).

With our disinfection - add-on, even higher effluent standards as for example required for discharge in marine waters of the state ALASKA. Additional class notations like BV Clean, BV CleanSuper, DNV-GL CleanDesign and AWT-A/B can be issued on request.

Parameter	COD	BOD	TSS	TC	pH	TN	TP
Description	chemical oxygen demand	biological oxygen demand	total suspended solids	thermo-tolerant coliforms	-	total nitrogen	total phosphorous
Unit	mg/l	mg/l	mg/l	cfu/100ml	-	mg/l	mg/l
Value	50	≤ 5	≤ 5	100	6.5-8.5	≤ 20	≤ 1

CS-MBR effluent quality exceeding IMO MEPC 227(64) requirements for special areas.

Worldwide Sales & Service Network



Always Near – Always Available

RWO's network of more than 40 qualified sales and service center throughout the world ensure customer benefits due the short communication links to short response times. Thereby, our wide ranging expertise and our products, as well as services has made us a reliable partner in the maritime industry.

Spare Parts

RWO offers original spare parts for all types of water treatment applications. Please contact us for further information: spares@rwo-gmbh.com

Service

Depending on our customers' demands, we offer an individually designed range of services. With our large service network, and our competence in process engineering, we have optimized our service offer: service@rwo-gmbh.com

The Service Range Includes

- > Full service including preventive maintenance, repairs, supply of spare parts and consumables as well as troubleshooting
- > Optimization and updating of the control and measuring technology
- > Support helpline: standby with agreed response times
- > Training of the operating staff

Your Full Customer Care Experience

With the combination of RWO Spare Part Kit and RWO Service Inspection you will benefit from a full Customer Care Package all around the world.

A Spare Parts Kits

- > Emergency Kit
- > Regular Kit
- > Intermediate Kit
- > Docking Kit

B Service Inspection

- > Basic Inspection
- > Extended Inspection

C Customer Care Packages

- > Gold member
- > Silver member
- > Bronze member
- > Basic member

Keep the Heart of Your OWS Protected

It is crucial to have the right spare parts when you operate your oily water separator. Our spare part kits are available from an Emergency Kit upto a Docking Kit.

- > **Emergency Kit**
Reliable protection right from the start. A reliable kit covering basic parts you need in case of 'emergency'.
- > **Regular Kit**
The best choice to keep your machinery running. This kit contains control cabinet, mechanical and consumables components.
- > **Intermediate Kit**
According to maintenance schedule this kit ensures operational reliability after 2,5 years operation. Recommended to this kit is the **OWS - Basic Service Inspection** to extend the guarantee.
- > **Docking Kit**
An all-round kit, containing additional extended components at recommended interval of 5 years of operation. Recommended to this kit is the **OWS - Extended Service Inspection** which facilitates the renewal of the IOPP-Certification incl. the OMD-Recalibration.

Key Features & Benefits

- > Minimized lifecycle costs
- > Improved OWS performance with OEM-parts
- > Minimized unexpected failures
- > Keeping downtime at a minimum
- > Ensuring operational efficiency
- > Correct and timely maintenance

USCG Type Approved



Ballast Water Treatment Systems

ERMA FIRST FIT BWTS

EXCELLENCE OF SIMPLICITY



ERMA FIRST ESK ENGINEERING SOLUTIONS S.A.

OPERATION

ERMA FIRST FIT BWTS is a full flow electrolytic system that operates only during ballasting

BALLASTING

FULL FLOW ELECTROLYSIS

During ballasting, the water goes through the filter, where organisms and sediment (with a diameter larger than 40 microns) are separated and further discharged overboard.

The filtered water enters the Electrolytic Cell. From the chlorides of the water, free chlorine is produced through the electrolysis process at a very low concentration (around 4-6 mg/L). The treated water then, enters the ballast tanks.

DE-BALLASTING

CONSIDERABLE GAINS

During de-ballasting, the system will only monitor the residual oxidants and will further intervene if necessary. The main stages of the system (filtration and disinfection) are bypassed.

A Total Residual Oxidants (TRO) sensor samples the residual chlorine at the discharge line. If it is greater than 0.1 mg/L, a dosing pump is operated for the dosage of neutralizing agent (Sodium Bisulfite). Successful neutralization of free chlorine is confirmed by a second TRO sensor, installed at the far end point of the ballast discharge line.



FULLY CERTIFIED

IMO & USCG type approved, suitable for all water types



EFFECTIVE DISINFECTION

continuous R&D on electrochemistry for innovative applications



SMALL FOOTPRINT

developed to exceed all special installation requirements



SMART SAVINGS

competitive CapEx & low OpEx for a system fit for your pocket

TECHNOLOGY

The success of ERMA FIRST FIT BWTS lies in its simplicity and the proven technology followed.

ERMA FIRST FIT BWTS incorporates the most reliable and efficient filtration followed by a state of the art disinfection stage. Mechanical separation refers to a 40 microns automatic backwashing filter. The disinfection stage takes place in our own-design, highly customized electrodes, providing the appropriate amount of disinfectant agent whilst consuming minimum power. A special coating is applied on the electrodes, which are designed to minimize the production of harmful byproducts and have an extended life time of minimum 5000-6000 hrs.

SYSTEM

ERMA FIRST FIT BWTS is an autonomous and reliable solution for all types and sizes of vessels

ERMA FIRST FIT BWTS

EXCELLENCE OF SIMPLICITY

ERMA FIRST FIT BWTS is an advanced modular system that was developed to exceed all the special installation requirements either for newbuild vessels or any retrofit projects. The major components of the system are a high-end backwash filter and an electrolytic cell with outstanding performance. Covering an extensive capacity range of 50-3740 m³/hr and being certified for operation in the most challenging conditions by the IMO, USCG and classification societies, ERMA FIRST FIT BWTS is an ideal solution for all types and sizes of ships.



SEPARATION

40 microns self-cleaning automatic screen filter

(two options available)



DISINFECTION

Advanced quality Electrolysis Cells

BENEFITS

ERMA FIRST FIT BWTS is an autonomous and reliable solution for all types and sizes of vessels

Simple and Flexible

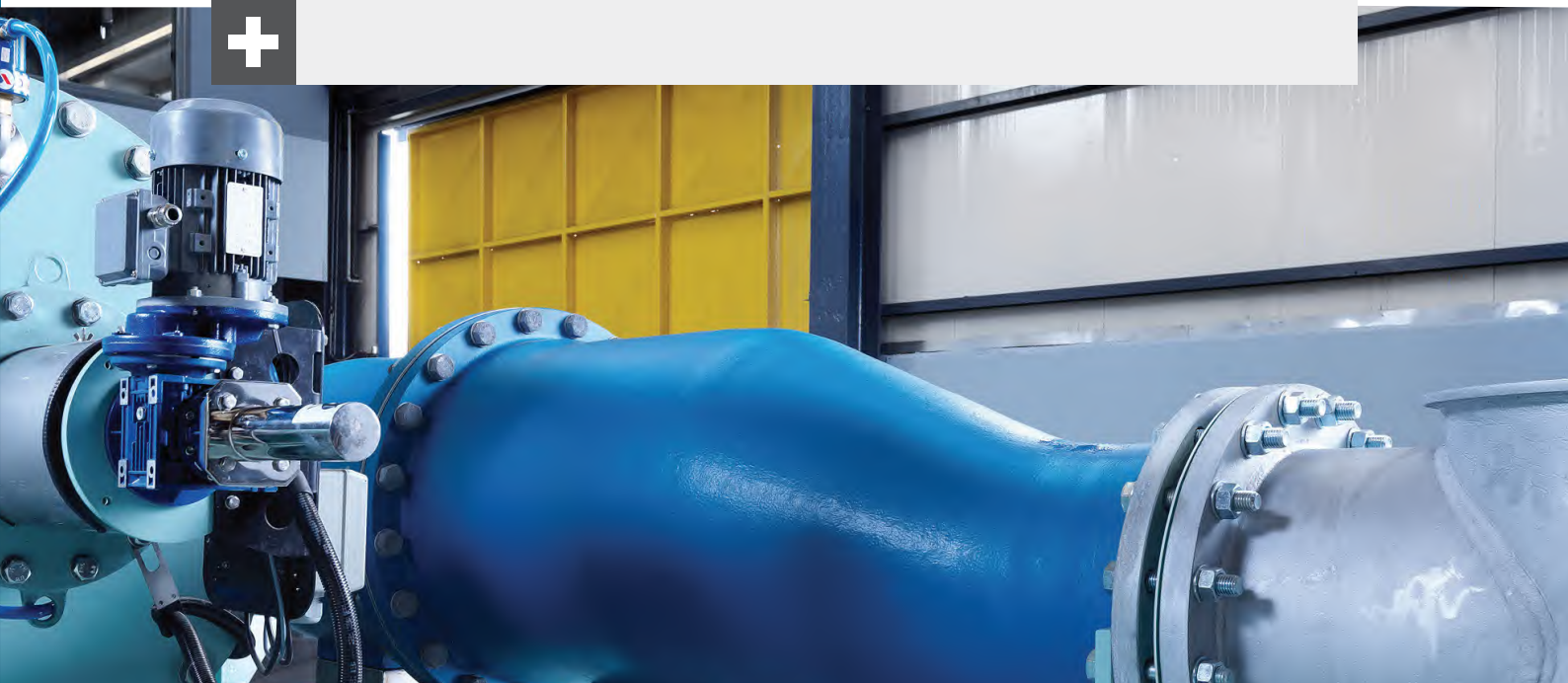
Suitable for all Pump Capacities

Suitable for all Available Spaces

Low Pressure Drop (0,5 bar)

Suitable for Fresh Water (0,9 PSU Salinity) & Low Temp. Waters (-2°C)

Low Power Consumption in Various Waters (1,8 kW/100 m³ at 30 PSU)



CERTIFICATION

ERMA FIRST FIT BWTS is fully certified according to the IMO, the USCG and the Classes



IMO Final
Approval



USCG Type
Approval



LR Class Type
Approval



Certification
ISO 9001



Certification
ISO 14001

NETWORK

ERMA FIRST serves ships internationally through an expanding agents network and service stations

SALES NETWORK

Belgium
Brazil
China
Croatia
Cyprus
Denmark
Estonia
Finland
France
Germany
Greece
Hong Kong
India
Israel
Italy
Japan
Korea
Latvia
Lithuania
Netherlands
Norway
Poland
Portugal
Romania
Singapore
Spain
Sweden
Taiwan
Turkey
United Arab Emirates
United Kingdom
United States of America

SERVICE STATIONS

Brazil
China
Denmark
Finland
Greece
Japan
Korea
Netherlands
Norway
Panama
Singapore
Sweden
United Arab Emirates
United States of America

ERMA FIRST ESK ENGINEERING SOLUTIONS S.A.

oneTANK
AN ERMA FIRST COMPANY

Ballast Water Treatment **SIMPLIFIED**

**Smallest Footprint.
Lowest Cost.**



Follow us on:



System description

With the smallest size, **oneTANK** is the best solution when space and available power are extremely limited. It is suitable for vessels, not highly depended on ballasting operations with one or few tanks.

Treatment

Ballasting procedure is conducted without any system integration. Disinfection takes place by injecting liquid bleach into the ballast tanks through a simple circulation loop and mixing nozzles. Once treatment is completed within holding time required, excessive chlorine is neutralized and ballast water is ready to be discharged overboard.

Installation - Operation

oneTANK has minimized footprint, weight and installation materials, leading into a timely retrofitting on board without any specialized workmanship requirement. Perfect match for newbuilding or existing vessels.

Systems are off-the-shelf while maintenance is simplified as no filter, complex UV lamps, electrolytic reactors or transformer rectifiers are incorporated.

Why oneTANK

- ✓ One-size fits all, units on stock
- ✓ Easy to ship due to small size
- ✓ Very low operational costs and simple maintenance
- ✓ Bulk chemicals are common substances, widely available on every market
- ✓ Standard spare part packages available
- ✓ Aftersales support by ERMA FIRST extended network worldwide

Operational Limitations:

Type Approved

Particulars

Support Services

USCG & BWMS
Code Approved

